

Genetic Variability in a Population of *Tropisternus collaris*
(Fabricius)

(Coleoptera: Hydrophilidae)

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A large series of *Tropisternus collaris* (Fabricius) from Lago de Ayapel, Colombia, shows relatively little variation in the extent and pattern of the markings of the dorsal surface. The general coloration is very dark in comparison to typical *collaris* from Venezuela and other areas of South America and resembles *T. paranensis* Sharp described from Parana, Brazil. The latter, however, is replaced by a different melanic form in the Matto Grosso of Brazil, and the Colombian form seems to be isolated in northwestern South America.

The Colombian form has proven tractable in the laboratory and freely interbreeds with the North American subspecies formerly assigned to *T. mexicanus* (Castelnau), (Young, 1964). The inheritance of the different color patterns, however, proves to be complex and in order to study this in more detail a number of minor variants of the pattern in the Colombian strain were selected and individuals showing the extremes were interbred. Pure lines have not yet been established because of the occurrence of inbreeding decline and what seem to be lethal or semilethal genes. All individuals of the Colombian strain are, however, inbred since all derive from the progeny of a single female.

Reduced Pronotal Blotch

Reduction of the extent of the melanic blotch on the pronotum is a characteristic of the color pattern of all the color forms of *collaris* except some individuals of the Colombian strain, *viridis* from Florida, and *paranensis* from southern Brazil.

One of the variants in the laboratory population shows varying degrees of reduction of the pronotal blotch in the form of two inverted "V"

TABLE I.

Cross	Observed		Expected		X ²
	rd	+	rd	+	
rd x rd	22	0	22	0	—
rd x rd	13	0	13	0	—
rd x rd	41	0	41	0	—
rd x +	4	9	6.5	6.5	0.96
rd x +	7	15	11	11	1.45
+ x +	21	36	14.25	42.75	1.57
+ x +	10	34	11	33	0.04

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shaped incisions of the hind margin one on either side of the middle. That is, dark pigments fails to form in these areas in the fully hardened individuals in contrast to the majority of specimens from the original sample. Extremes of this condition were selected and crossed.

The ratios in the expected column are calculated on the following assumptions:

- 1) rd individuals are homozygous recessives for a gene affecting pigment formation,
- 2) + individuals were all rd/+ heterozygotes.

Although the + type was frequent in the wild population no crosses in the laboratory produced all + type individuals. Some rd crosses produced individuals in which the reduction was feeble, but in all crosses of rd x rd the offspring showed some degree of reduction of the pigmentation.

Extension of Bronzing on the Elytra

The extent of the green bronzing which characteristically overlays the dark stripes of the elytra is variable. In some individuals of the Colombian strain the extension is so great that the entire disk of the elytra appears solid green and stripes are detectable only on the apical portions. This condition contrasts to the more usual appearance in which the elytral stripes are separated by dark bars of melanization without bronzing. Crosses between individuals showing varying degrees of extension of the bronzing suggests that the condition is due to several genes, and that dominance is not involved.

Several crosses in which both parents were intermediately bronzed produced 5 solid green, 48 intermediate, and 4 dark bar individuals. This is suspiciously close to the results expected if the intermediately bronzed individuals were heterozygous for two alleles affecting this character (X^2 , 0.13 not significant if intermediate phenotypes cannot be distinguished). However, crosses in which one parent was dark bar and the other intermediately bronzed gave 5 solid green, 21 intermediate, and 64 dark bar. This should not be true if the black bar individuals are truly homozygous. It, therefore, seems that more than two alleles must be involved unless the phenotypic expression is influenced by other factors.

The action of several genes rather than a single pair is also indicated by the results of backcrosses of hybrids in which the original parent was intermediately bronzed and the backcross parent dark bar. Three such backcrosses gave collectively 6 solid green, 23 intermediate, and 15 dark bar. Another backcross in which the original parent was dark bar and the backcross parent dark bar gave 6 intermediate and 12 dark bar offspring.

The difficulty in analyzing these crosses lie principally in the inability to distinguish the intermediate genotypes on the basis of phenotype.

Individuals showing the solid green appearance also show a reduction in viability and most die before mating. Thus, selective elimination of the homozygotes may be taking place since the character cannot be readily assayed in larvae. One mating of solid green x dark bar pro-

duced a line in which the larvae show a peculiar thickening and darkening of the integument at the anterior portion of the thorax giving them a characteristic dumpy appearance. This is apparently due to some interference with ecdysis. These "dumpy larvae" also appear in other lines, but none of those which have survived produced solid green individuals.

Mortality and Lethal Genes

Mortality is very high in all lines of the inbred Colombian strain. In contrast, hybrids with other forms of *collaris* show greatly increased viability and larval survival.

The "dumpy" condition mentioned above occurs in several lines. It behaves as if due to a gene or genes the effects of which are expressed with great variability in the heterozygotes.

The original cross producing "dumpy" was made in November, 1964. If the condition developed before the first molt it was nearly always fatal. However, if the larvae succeeded in passing the first instar before the condition developed some completed the second molt and pupated. Two families were reared from this original cross with the following results:

	Normal larva	Dumpy larva died before pupating	Died without feeding	Adults
Family 1	24	8	8	18
Family 2	20	5	4	7

The female parent from this cross was mated with a male from another line producing dumpy larvae. Eight eggcases could be attributed to matings with this male, but only 2 larvae hatched and these died immediately without feeding.

Other crosses which also produced dumpy larvae showed even greater variability in the expression of the character. In one about 2 larvae of 20 and 4 of 19 were dumpy in two families reared. In the latter, however, all four dumpy larvae completed metamorphosis.

A cross of two offspring from normal larvae in this line produced one family with 16 normal to 13 dumpy larvae, but only 6 survived the second molt. Of these all 3 normal and 1 of the dumpy completed metamorphosis.

The dumpy trait has persisted in offspring of these original crosses, but with variable expression, and in most with greatly reduced frequency of dumpy larvae.

In another line very high early larval mortality was observed, but this trait seems to have disappeared in the survivors. Dumpy larvae also appeared in this line among larvae which survived early mortality.

Dark Larvae

Two clusters of very melanic larvae have appeared in different lines. These behaved normally, but usually died before metamorphosing. Two adults reared from them died before crosses could be made. It is tempting to consider these very dark larvae due to new mutations, but the occurrence in different lines suggests that they represent rare recombinations which have semi-lethal effects.

Masted Eggcases vs. Mastless

Most species of *Tropisternus* spin eggcases which incorporate a mast or ribbon which is presumably respiratory in function. The original female from the Colombian strain produced eggcases with a typical mast which extended above the water's surface. In her offspring, however, several females produced eggcases without sign of mast or ribbon. Eggs from these hatched normally, and the peculiarity has persisted both in the inbred lines and in hybrid crosses. The expression in some is variable, a female producing mastless, shortmasted, and fully masted eggcases at different times during her life, so it is still uncertain whether this is an inherited behaviorism or a product of laboratory conditions.

Summary and Conclusions

The data summarized above indicates that the wild population of *Tropisternus collaris* from which the laboratory population being studied was derived must have contained a considerable number of mutants. Some of these indicate genetic control of even very minor peculiarities of the color pattern, but the majority of the genetic variation seems to be involved with physiological characteristics involving growth, viability, and maturation.

Several of the physiological characters are highly detrimental if not lethal under laboratory conditions. It is not certain, however, that these are equally detrimental in nature. For example, interference with ecdysis appears to be counteracted to a degree by heavy feeding. Thus under optimal conditions it may have ultimately beneficial effects in prolonging the larval life of part of the population.

The rapid departure of various lines in the laboratory from what seemed to be a characteristic wild type is also interesting. One must assume that remarkably powerful selective forces must be acting to maintain a constant type in nature. If this is true, the implications for taxonomy are clear. Varieties of this species, if not species in general, cannot be defined on the basis of morphological characteristics alone because they exist as extremely plastic populations dependent for their ultimate expression upon a complex interaction of genetic factors and environmental conditions.

Reference Cited

1964. YOUNG, FRANK N. Hybridisation between North and South American *Tropisternus* (Coleoptera: Hydrophilidae). Proc. XIth Intern. Congr. Ent., London, p. 246.